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Cross-border Data-sharing Pilots

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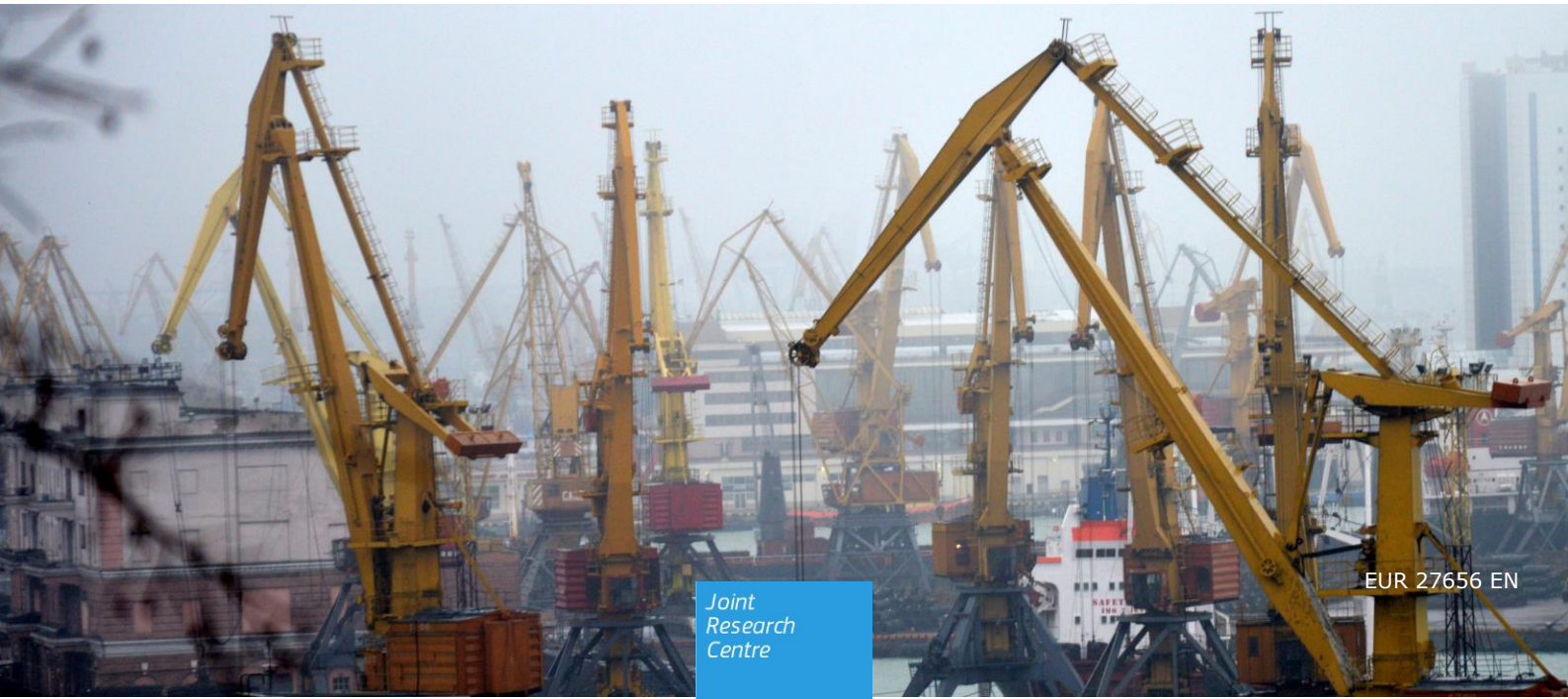

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Abstract

The Danube Reference Data and Services Infrastructure (DRDSI) project currently provides access to more than 6 700 datasets, relevant for one or more Priority Areas of the EU Strategy for the Danube Region (EUSDR). These datasets can act as a solid foundation for integration of scientific knowledge into the policy making process on different levels (local, regional and international). From the perspective of macroregional strategies, this would only be possible if data can be used across borders and domains, and put in the right context. That is why the DRDSI project aims at establishing a series of pilot projects which would (i) fill existing gaps through the establishment of missing infrastructure components, such as discovery and view services, (ii) harmonise datasets for cross-border and cross-domains, and (iii) demonstrate the benefit of scientific data for policy support through the creation of value-added products. This JRC technical report aims to provide a synthesised overview of the pilot projects which will be finalised in 2016.

1. Introduction

The Danube Reference Data and Services Infrastructure (DRDSI) [1] is helping to create a data-sharing infrastructure in support of the EU Strategy for the Danube Region (EUSDR) [2]. Launched in June 2011, the EUSDR aims to boost the development of the Danube Region. The macro-regional strategy relies on an integrated approach to encourage better policy development and the alignment of funding and resources through concrete actions and projects, resulting in a more efficient and better-balanced implementation of the EU's overall objectives under Europe 2020.

For the DRDSI, this involves both supporting the creation and evolution of an open data platform and the organisational context of stakeholders in the region to populate and use the platform. Since 2014, a series of activities were initiated to help develop the open source platform and fill it with initial content from the Danube region. A key feature has been the creation of an open data catalogue that is, in itself, already a useful product of the DRDSI project, covering over 6,700 datasets originating from research projects, the work of other JRC Nexi supporting the EUSDR, accessing the official records created under open data and INSPIRE initiatives and data sources from the EC and other international initiatives.

A great deal of this work has been supported by the Danube_NET, a group of experts working in the Danube Region with the DRDSI to identifying stakeholders organisations and provided the initial metadata records that point to the datasets the platform is now accessing. As the dataflows from Danube_NET, the Nexi and other partners are becoming more mature, the work of the DRDSI has started to explore what other content could potentially be shared through the platform.

From the work with the Danube_Net, in particular, it became clear that a series of pilots was needed to build capacity and demonstrate how data harmonisation activities could be built on and contribute to the DRDSI. Already, the INSPIRE Directive (2007/2/EC) [3] provides an approach to spatial data harmonisation and a policy context to help harmonise data and underlying data-sharing services for a large range of topics.

The approach of the DRDSI project, therefore, has been to demonstrate how INSPIRE be applied to further strengthen the data infrastructure the project is creating. Supported by evidence from the Danube_NET it also became clear in setting up the pilots that full data harmonisation across the region would not be possible in the lifetime of the project, in part due to limitations caused by only emerging data policies and by the implications of legacy systems in many cases. The pilots, therefore, aim to develop products, services and content for access through the DRDSI Platform that promote INSPIRE and open data concepts while building capacity in particular countries in these topics.

This work has also been supported by a series of workshops with Danube_NET members and other stakeholders in the region, including a concept-based meeting in mid-2015 that explored how sharing spatial data can contribute to sustainable growth in the region. All pilots have recently been launched and the findings and lessons learned from this work will contribute to the conclusions of the DRDSI project as a whole.

The pilots can be divided into three main groups, presented in the following sections of this report. The first group involves data infrastructure pilots that help establish services to populate the DRDSI in a sustainable manner, focussing on work in Serbia and Ukraine (Section 2). The second group of pilots focusses on cross-border data harmonisation, involving reference data coming from organisations in Ukraine and Moldova and expertise from Germany, which also acts as a knowledge-transfer case (Section 3).

The last group of pilots aims to create harmonised, comparable and open macro-regional data of interest to the EUSDR, focussing on examples for policy-related indicators, for

the protection of the regions cultural heritage, thus extending the scope of INSPIRE, and the creation of value added products with and for citizens through an application for urban agriculture in Slovakia that could be extended to other countries (Section 4). The document concludes with a discussion of the desired outputs from the pilots, including the lessons already learned in their set-up (Section 5).

2. Data Infrastructure Pilots

2.1 Background to the Data Infrastructure Pilots

The focus of the work on the DRDSI is the access to, and sharing of, geospatial data that is typified by the requirements of the INSPIRE Directive [3] that aims to build a European Spatial Data Infrastructure (SDI). These developments already well underway in the EU Member States, that is building on the SDIs at regional and national levels to provide access to data for use in environmental policy-making and assessment. The data infrastructure pilots have been designed as exemplars for other countries to follow that are interested building capacity in SDI and the federated approach the infrastructure promotes.

The focus of this work is to mobilise existing content to provide information for the DRDSI and to fill gaps in existing information that will help data to be better managed for wider access and potentially offer experience in modernised metadata management as part of a larger data infrastructure.

The activity focusses on two cases, one from Serbia, which has recently made major investments in its national SDI geoportal, and the other from Ukraine, where the DRDSI project as a whole has been aiding the rapid development of their approaches to spatial data-sharing, in some cases starting from paper maps that have need to be digitised.

The two cases are described in more detail, below.

2.2 The Serbia Infrastructure Pilot

The purpose of this work is to establish a 'local node' for the DRDSI in Serbia and to explore how this approach could be adopted by key actors in the country. This work will create a ready and sustained means to harvest metadata using an open data approach, based on the technologies used by the DRDSI platform. In addition, it acts as a demonstrator for other organisations to share data by documenting the approach and experience gained, creating further content for the DRDSI Platform.

The main objective of the work is to create a standardised approach to obtain existing metadata. This includes creating an Open Geospatial Consortium (OGC) based Catalog Service for the Web (CSW) endpoint that will contain all metadata relevant to the EUSDR for consumption in the DRDSI platform that comes from heterogeneous sources. The creation of such a system will mean that metadata are not only available for the DRDSI but also potentially for other open data platforms, thus creating a more sustainable approach to managing metadata and some help towards INSPIRE implementation in Serbia, which is looking towards EU membership.

To make best use of the developments in this case, the work will also involve promotion of the approach with other organisations in Serbia, so that others can be encouraged to make data more readily flow to the DRDSI. This is felt to also help establish more sustained partnerships for data-sharing within the country and hopefully for the Danube region as whole. In particular, the work will involve two other key public sector organisations, where the Serbian Environmental Agency and Statistical Office are seen as good candidates for cooperation.

A particular emphasis has been put on providing resource locators for relevant data (registered through the dataset metadata), pointing to both view and, wherever

possible, download services. The service node instance for the DRDSI will aim to serve relevant metadata records and services in an unrestricted way (as defined in INSPIRE), although it is possible that not all relevant data can be licensed as open data. The approach, however, should aim to support the reuse of data which, in turn, should lead to increased efficiency in decision-making, more targeted research and potentially value-added products contributing to growth and job creation in the country and region.

The content of this work will include creating a defined set of data records in both Serbian and English, following a metadata application schema that is in accordance with the requirements of the INSPIRE Directive. This work will also include reusing existing metadata records or individual metadata items (i.e. the pieces of information metadata requires, such as data publisher, date of creation or resource locator), as well as creating additional records or metadata items within the scope of the DRDSI. Importantly, the metadata will also contain details of any access control or licencing restrictions related to the dataset.

To further explain the approach and share experiences with others in the region, the work will provide details about work involving the presentation of User Stories[1] in the DRDSI Platform that help explain how metadata and data can be used to support the DRDSI. This work will involve documenting the improved accessibility and availability of good quality metadata from the above work and how this is improving both the core business of relevant institutions and the benefits arising from collaboration with other stakeholders. Another example is the data used in the context of Public Private Partnerships, which also includes the sharing of data with citizens to better manage agricultural holdings.

Overall, the approach and technologies used should be transferable to other organisations interested in, but not yet familiar with, SDIs and INSPIRE.

2.3 The Ukraine Infrastructure Pilot

The Ukraine pilot involves a similar approach to the Serbian case but takes into account the organisational setting of their NMA, the Ukrainian State Cadastral Centre, and the resources available in their country, where the development and sharing of metadata has been somewhat limited until now.

The purpose of this work is to establish a Ukrainian metadata endpoint and add content and value to the existing DRDSI platform by again creating a 'local node' and to establish the CSW endpoint containing metadata relevant to the EUSDR that the DRDSI platform can then harvest. This approach is, again, seen to be a potential investment not only for the DRDSI but also an aid to the reuse of such metadata in other open data platforms.

The metadata within scope to the EUSDR follows the scoping of the Danube_NET and work will also explore collaboration with other organisations who could potentially offer their metadata to the DRDSI Platform. Again, a simple list of target datasets will be created early on in the process of setting up the CSW and records will be made available in Ukrainian and English. Should any dataset and/or service within scope require password protection or other form of access restriction, the metadata being serviced will explain these restrictions. This also has implications for how data can be defined as open data, as both policy and technical barriers need to be made clear to potential users of a dataset. This work will also be an opportunity to understand why data access restrictions are being put in place and the possible approaches that could be adopted to make data more freely available in Ukraine, bearing in mind the data-harmonisation pilot discussed below (see Section 3).

[1] http://drdsi.jrc.ec.europa.eu/user-story

Using the same standards-based approach as Serbia will also offer some comparison between countries in the issues encountered in implementing the standards and technologies and lessons-learned for other organisations. More formally, this work will also produce user stories, including presentation of the value being added to their data management activities stemming from the establishment of the metadata catalogue solution and examples of data usage relevant to the EUSDR that will build on the metadata held in the catalogue. This latter example is the main approach of User Stories as a whole, helping to go beyond metadata catalogues to show what data sharing provides to real-world research and policy-making applications.

Investing in infrastructure technologies and making improvements in information management are important steps to supporting data-sharing for a macro-region. The next important step is the harmonisation of data between partner organisations.

3. Cross-border Data Harmonisation and Knowledge Transfer Pilots

3.1 Background to the Data Harmonisation Pilots

Data harmonisation is both a challenge and an important opportunity for organisations sharing and using reference data in the EUSDR. The need for harmonised data is driven by a need for comparability, so that, for example, measurements can be made and reported consistently, problems understood and communicated by parties in the same way and methodologies and tools developed to fit a range of needs, thus breaking down silos between domains to create reusable data for a range of applications. In the case of the EUSDR, data harmonisation can provide an important means to agree on the extent of territorial issues on the ground and the way those issues can be both analysed and results shared for other uses, thus creating a common framework for decision-making. Within this context, pilots have been set up as a cross-border use case between Ukraine and Moldova to create comparable data on agreed themes. To bolster this effort, expertise is being added by WeTransform GmbH, a company specialising in spatial data transformation and open source tools, especially their own Humboldt Alignment Editor (HALE[2]). This work provides an additional example of how knowledge on the topic can be transferred from more developed settings to partners outside the EU.

The three complementary cases are described below in more detail in terms of the data providers and expert perspectives.

3.2 Data providers and harmonisation pilots

This work focusses on harmonising some of the data holdings belonging to the NMAs of Moldova and Ukraine as a cross-border use case in the Danube Region. This work is also helping to up-skill these organisations in the data harmonisation task, following the approaches being developed and implemented in other countries following INSPIRE requirements. On the basis of these pilots and their outputs the organisations themselves and partners can explore how other data could be harmonised as part of the EUSDR or other data infrastructures.

The purpose of this work is to add content and value to the existing DRDSI platform by creating harmonised data for the EUSDR, and demonstrate a cross-border use case between Moldova and Ukraine, based on INSPIRE. This work involves filling in gaps in regional datasets by creating harmonised data for the two countries at the largest possible scale and documenting results for use in the DRDSI platform, as well as presenting outputs to stakeholders of the EUSDR. The objective is to create a worked example of data harmonisation for around five datasets relevant to the EUSDR, thus creating new macro-regional reference data for the Platform. To aid the potential reuse of this new harmonised content, all the data and metadata created should ideally be made publicly available for view and download.

Already some work has taken place in this context, including for international datasets such as EuroGeographics "EuroRegional map" and the efforts in this pilot will be to complement such resources to make accessible new data and associated metadata. This work involves four main stages.

[2] https://www.wetransform.to/products/hale/

Firstly, data will be selected covering at least 500 sq. km of the territory of the Danube basin within the two countries. An approximate reference scale of 1:100 000 (or more detailed) has been selected. As reference data are being sought, preference is being given to reference geographies such as the Administrative Units data theme specified in INSPIRE, as such data ca be used in, for example, planning process as well as some regional statistics. At this first stage data will be shared either as a package or through services for the following work.

Secondly, the organisations will draft mappings between their source data and the target schemas required by INSPIRE's data models. These mappings will be reviewed by the JRC and other experts so that definitions in INSPIRE are well understood and all available spatial objects (the building blocks of the data models INSPIRE has specified) can be taken into account in terms of both structure and content. Resources such as the INSPIRE Data Specification toolkit[3] can be used to help scope the necessary building blocks and related information (such as codelists) that the harmonised data will need. Once the mappings are agreed, INSPIRE compliant data can then be produced in Geography Markup Language (GML) that can then be documented and shared online.

Thirdly, therefore, the pilots will involve serving the output data as both INSPIRE View Services, as OGC Web Map Services (WMS), that provide an online preview of the data being produced for end-users, and INSPIRE Download Services as either OGC Web Feature Services (WFS) or Web Coverage Services (WCS), that allow end users to process the data being shared on their local machines, normally in analytical packages such as Geographical Information Systems (GIS). A preference is being given to well-established open source technology to serve the data and the services coming from this work will be made accessible without any restrictions for a further 18 months, allowing further testing and experimentation.

Lastly, in order to ensure that the View and Download services of the new data are easily found, metadata will be created for the DRDSI platform, including their resource locators. In addition, more user stories will be created for the DRDSI platform to describe the results of the harmonisation activity, the lessons learned and examples of possible applications of this data in support of EUSDR as well as policy support on other levels. Dissemination of the results is also planned at an event being planned by the JRC to explain the findings to a wider technical audience.

Overall, the experience of harmonising these datasets according to INSPIRE and contrasting the approaches between the two countries for the test area will provide important evidence about the benefits and challenges being met through this work and where additional support could be needed to make more data available through this approach both in the participating organisations and with their partners at a national level.

3.3 Data harmonisation expertise pilot

The main approach of this work is to provide the technical guidance, support and skills needed to take the data providers material and transform it into INSPIRE data, while documenting some of the issues encountered from the technical perspective. This work involves supporting three joint datasets selected in the Moldovan and Ukraine cases, including support to create any missing metadata that would be made accessible to the platform and, in turn, the User Stories.

For the data harmonisation tasks two main phases are foreseen. The begins with conceptual mapping through consensus building among domain experts who will discuss

[3] http://inspire-regadmin.jrc.ec.europa.eu/dataspecification/

how a particular source data model (the representation of the dataset to be transformed) can be mapped to a target data model, in this case a model required by INSPIRE. The more detailed steps for the mapping involves target mapping (i.e. scoping parts of target models); source scope (establishing which source data meet the target's requirements); mapping source and target data 'types', classes or tables; and mapping properties from source to targets. This work is supported by the use of mapping tables that contain source and target structures. Such work can also help to analyse in detail the supply and demand of data, as INSPIRE may require objects that are not present These mappings and source data are then loaded into HALE[2] for execution, to support the actual transformation of the data to the target schema. Once the project file for the transformation alignment is created in HALE it can be saved and reused for other transformations in whole or for any parts.

The advantage of using HALE is that it also automatically validates the transformations using different validation engines. It also contains WFS functionality through other open source tools, Geoserver[4] and deegree[5]. This combination of open source packages is one of the reasons this expertise was brought into the case studies, as the approaches can be readily adopted by others.

One of the additional outputs of this work is a report summarising the results and key findings of this work, alongside lessons being learned in data-sharing that could aid the unlocking of data in the scope of the EUSDR. This will not only be valuable for the participating organisations and DRDSI project as a whole but also others interested in creating macro-regional datasets.

Overall, this pilot provides expert support to the participating organisations in transformation tasks and technology but it also acts as an example of how knowledge transfer can take place within the region, enabled by small pilots and projects that bring together partners to explore how data-sharing can be enabled and what other capacities may be needed to create a more sustainable activity. This will also provide important lessons for other countries and organisations aiming to contribute data to infrastructures, including those in neighbouring regions to the EU, such as those in the Western Balkans.

[4] http://geoserver.org/
[5] http://www.deegree.org/

4. Data Harmonisation Thematic, Reuse and Value-added Pilots

4.1 Background to the other Data Harmonisation Pilots

The previous pilots have outlined cases on modernising organisations to help them contribute effectively to a data infrastructure and demonstrate how to create comparable data. In order to explore the benefits of data harmonisation three other pilots have been established with different approaches to creating macro-regional data that build on INSPIRE. More importantly, they aim to demonstrate the value of using open data approaches and principles to power the development of their applications.

The first pilot aims to fill gaps in the underlying data of the DRDSI by creating a common view of indicators that can be used for policy-making, complementing existing resources and following some traditional GIS-based approaches to dataset analysis and new data creation.

The second pilot aims to demonstrate how open data coming from expert citizens can be used to drive analyses about different topics in a common spatial frame, including those outside the main focus of INSPIRE but reusing some of its data models. The third pilot looks towards the potential reuse of DRDSI platform content, again involving citizens and considering topics outside the main focus of INSPIRE, by creating feely available applications, potentially as mobile apps. Together, these pilots provide an important contribution to show how SDIs and the DRDSI in particular can be used for range of purposes.

4.2 Macro-regional Indicators Use Case

GIS are built for spatial data-handling. Building a 'bridge' between GIS usage and SDIs is one of the key points of this pilot. Such a step is evident to the SDI community but the concrete approach to connecting an existing data resources such as the DRDSI to analytical approaches and new outputs can be documented and followed through this case.

The purpose of this work is to create new comparable quantitative data that covers the Danube region (for the NUTS2 and/or NUTS3 levels and equivalents in non-EU countries) based on harmonised content and geospatial analysis. This work involves identifying and filling gaps in existing indicators from international actors relevant to the EUSDR, including the data created by European Observation Network for Territorial Development and Cohesion (ESPON[6]), Eurostat[7], and the work of the JRC already in the DRDSI Platform, such as the work on territorial indicators for regional development through the use of the LUISA database[8] by colleagues in the JRC Air Nexus.

The aim is to demonstrate the process of indicator creation and to show how open data can support research and policy-making. Not all topics can be covered but the selected datasets should be relevant to one or more Priority Areas of the EUSDR. The input data will mainly come from Danube countries' open data portals and existing content in the DRDSI Platform, alongside the potential use of large-scale resources, such as

[6] http://www.espon.eu/
[7] http://ec.europa.eu/eurostat
[8] See http://drdsi-data.jrc.it/user-story/luisa

OpenStreetMap[9]. The output indicators that will be produce could be both simple and multivariate but, importantly, will be made available through the DRDSI Platform as open data. For this reason, the contractor will have to check and properly report all licence and reuse requirements for the creation of data derivatives, which will both impact on the scope of this work as well as providing important experience about the reuse of open data for such purposes, including both strengths and weaknesses.

The work will also involve several stages and tasks, starting with an analysis of the existing indicators by major actors in the Danube region, as noted above. Based on these gaps, work will explore which accessible data from the DRDSI platform, other JRC sources and other inputs could be used for indicator development, taking into account both their scope and spatio-temporal coverage for subsequent analysis. The aim will be to create five indicators relevant to the EUSDR, with outputs including the indicator datasets, details of their definition, the variables involved, the input datasets and the methodology used for their generation, as well as dataset metadata based on INSPIRE metadata, a User Story about the approach for the platform and presentation about the work to an event to be organised with the JRC.

The final output of this work will be a report summarising the key findings and lessons learned related to data-sharing for indicator development, taking into consideration any technical or legal barriers encountered when trying to access or reuse relevant data. Such a benchmarking exercise will not only provide useful indicators for the EUSDR but also help to take stock of how readily measurements can be made of use to, for example, ex ante assessments or other details that can support decision-making in the EUSDR or potentially other macroregions.

4.3 Cultural Heritage Protection Use Case

This pilot also aims to maximise the use of open data about the region, combining research outputs with citizen generated content and applying INSPIRE to create harmonised products from heterogeneous data sources. More specifically, in addresses topics within INSPIRE that are outside the core perspective of environmental policy by combining data to examine how the region's cultural heritage could be at risk from natural hazards, in turn creating new indicators about these topics. The work follows a similar approach to the Macro-regional Indicators Use Case (including the data licencing conditions it will face), and will involve identifying data already within the DRDSI and other sources, selecting data for further analysis and creating new indicators as regional statistics. In this case, however, more focus is placed on harmonising some of the open data according to INSPIRE, creating important lessons about the adoption of citizen-generated content for policy-making.

More specifically, the work aims to outline the whole process of data creation, including processing data to a common model and creating new indicators. Input data can, again, come from open data portals and the DRDSI platform but more emphasis is placed on the use of OpenStreetMap. Thematically, the pilot will explore existing data on natural hazards (e.g. floods, forest fires, etc.) with data for cultural heritage, both as cultural heritage sites and as museums or other buildings holding cultural artefacts.

This work will explore cultural heritage and natural hazards data sources including international organisations, such as the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM[10]), as well as details from website such as Wikipedia. OpenStreetMap will be used to identify possible cultural

[9] www.openstreetmap.org
[10] http://www.iccrom.org/

heritage sites or hazard-related data and a data model will be developed reusing data models specified through the INSPIRE Directive's technical guidelines. Using INSPIRE will mean that those interested in the topic in other regions could adopt the same model and public administrations could have their data reused in similar application areas. Again, the JRC's Interactive Data Specification tools can help with the data modelling exercises, including the target data models, and data transformation tasks are foreseen to create new outputs datasets (alongside related metadata).

The creation of this harmonised data can then be used in new analyses for the whole region to show which cultural heritage sites and museums (etc.) are exposed to particular natural hazards, using GIS-based analysis techniques. Ideally, this work should involve discussions with experts and stakeholders at national or regional levels to ensure that the data represents their perception of the modelled risks for their cultural heritage sites. Based on this core dataset the data will then be aggregated to create region statistics on the NUTS2 and/or NUTS3 level. This can illustrate, for example via thematic mapping, the number of cultural heritage sites exposed to a particular hazard in a given area, and allow decision-makers, researchers and citizens in the region to see which parts of the region and its cultural heritage are facing particular risks.

Again, this work will be documented as a User Story and a report on the lessons learnt, for others to potentially follow both within the region and beyond. The advantage of this work is that it will also offer an important opportunity to demonstrate the strengths and weaknesses of open data in supporting such processes for research and policy-making. In addition, by grounding some of the data on citizen-generated content, it will be possible to create a resource where citizens can take a sense of ownership of the data produced and subsequent analyses. Such work can also help to draw some contrasts between official data and the use of less formal data sources, and explore how official data could be combined with results to support research-led conclusions. Moreover, the approach in this case could produce data for use in mobile applications, as the output data will be standardised and reusable according to both INSPIRE and open data principles.

4.4 Urban Agriculture Application

The last DRDSI pilot also relates to data harmonisation but focusses more on the reuse of data for value-added applications that have citizens as some of the intended end-users by creating and open source application. Such work not only provides useful evidence for policy-making but also provides a window on the potential of the region to create such data-driven products and services that could be applied in a range of cases, in turn illustrating data's contribution to the sustainable growth of the region.

More specifically, it focusses on a practical demonstration of such issues by creating a web and/or smartphone application (app) which addresses urban agriculture in Danube region cities. This pilot has been chosen for further development, having already one an open competition supported by the DRDSI at the DanubeHack event in October 2015[11].

The app will consumes data from readily available sources including, but not limited to, data coming from the DRDSI platform and other open data platforms (with the same issues of licencing checks discussed above). This application will be tailored to the needs of stakeholders in the Danube region, including urban farmers, land owners, local authorities, non-governmental bodies and residents. It is hoped that the app will involve data for urbanised areas in at least two Danube countries, aiding comparison and potential extension and reuse to other cities. The work also sees several stages of development.

[11] http://www.danubehack.eu

This begins with refining the scope and conceptual design of the app, including initial inputs from stakeholders (such as public sector organisations, NGOs and citizens), a mock-up of the application and details of the technology to be uses, where open source software will be explored in particular to help maximise reproducibility and reusability. The work will also involve defining in detail the data to be used based on the outputs of the DanubeHack event. This could include, for example, EC-related sources such as Urban Atlas, LUCAS, CORINE Land Cover that will feed the urban agriculture application, alongside any additional data collected from handheld devices or citizen engagement.

Based on these designs the end-user application will be developed along with relevant documentation for developers and end users. The work will also involve publishing the application (e.g. through mobile app stores) and collect feedback from end-users. Such an approach ensures that the output is not only fit for purpose but that those developing the app can understand how relevant it is alongside other approaches to help target urban land for agriculture. Ideally, events organised in the context of the EUSDR could also be used to gather feedback in order, overall, to improve the end product. Relevant public authorities will also be consulted about their potential demand for, and use of, the app in order to release a final version.

Again this experience of creating value-added products on top of the DRDSI resources will be documented in a User Story and final report. This work will, in particular, help others to understand how to make use of open data resources and tie the development to the creation of open source applications, creating a highly reusable approach within the Danube region and beyond. In addition, the work will also involve the promotion of this work in networks related to the topic and actors in the Danube region.

5. Conclusions

This report has outlined the different pilots the DRDSI is putting in place to strengthen the sharing and reuse of (spatial) data within the context of the EUSDR. These pilots cover different dimensions of a data-sharing related to infrastructure components, data harmonisation and using the data being made available.

This includes building capacity in sustainable flows of metadata and other data infrastructure components and by supporting the partnerships needed within countries to create such well-managed content, not only for macro-regional purposes but also for better decision-making within countries and institutions. Such investments will ensure that existing metadata can readily flow to the DRDSI from host institutions and that new metadata can be readily shared not only for the DRDSI but other data infrastructures, now and in the future.

It also includes, in terms of harmonisation, demonstrating how investing in common data models can readily create and serve comparable cross-border data following a standards/specifications based approach, while enabling the collaboration between organisations and the role of experts in facilitating such processes. This work also offers the opportunity to examine the strengths and weaknesses of knowledge transfer within the Danube region and where there may be opportunities for both innovation and further targeted capacity-building efforts.

Demonstrating how data can be used is becoming a necessary element of SDIs and open data. The DRDSI pilots in this case, therefore, aim to outline how open data and INSPIRE can power the development of new data for policy-making, research and value-added applications. In addition, the work will explore how citizens have a role in this context as both expert data providers in the case of OpenStreetMap and data consumers in both the cultural heritage and urban agriculture cases.

Although all the pilot case aim to achieve particular results in themselves, the work also is aimed at sharing evidence/findings and lessons learned with a wider group of potential stakeholders. This is including the creation of new User Stories for the DRDSI platform, which will connect metadata records held in the Platform's catalogue with descriptions of how the data was created and applied. Creating such reference examples can also be used to encourage others to follow these processes in, for example, the region's research communities. Moreover, in nearly all cases, the work will allow existing or new datasets to be shared and created for presentation in the platform as metadata. In many cases this can also help to raise awareness with new stakeholders about the scope and purpose of the DRDSI, potentially offering insights into how they can also contribute to the infrastructure.

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[2] EU Strategy for the Danube Region
http://ec.europa.eu/regional_policy/cooperate/danube/index_en.cfm

[3] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) (*OJ L 108, 25.4.2007, p. 1–14*), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007L0002:EN:NOT

List of abbreviations and definitions

CSW: Catalogue Service for the Web

DRDSI: Danube Reference Data and Services Infrastructure

EU: European Union

EUSDR: European Union Strategy for the Danube Region

GIS: Geographical Information System

GML: Geographic Markup Language

HALE: Humboldt Alignment Editor

ICCROM: the International Centre for the Study of the Preservation and Restoration of Cultural Property

INSPIRE: Infrastructure for Spatial Information in the European Community

JRC: Joint Research Centre

NMA: National Mapping Agency

OGC: Open Geospatial Consortium

LUCAS: Land use/cover area frame statistical survey

NUTS: Nomenclature of territorial units for statistics

RGA: Republic Geodetic Authority of Serbia

SDI: Spatial Data Infrastructure

WCS: OGC Web Coverage Service

WFS: OGC Web Feature Service

WMS: OGC Web Map Service

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